The kilometer tax and Swedish industry - Effects on sectors and regions

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Abstract: An introduction of a kilometer tax for heavy goods vehicles can be constrained by the risk of that higher production costs than competitors in other countries will negatively affect regions and industries of policy concern. We estimate factor demand elasticities in the Swedish manufacturing industry using firm level data for the 1990-2001 period on input prices and quantities. The results show that the introduction of a kilometer tax for heavy goods vehicles decreases transport demand and increases labor demand. The effects are less pronounced in terms of changes in output, though some industries (e.g. wood, and pulp- and paper) can be expected to be affected more than others due to their dependence on road freight transport. The regional dimension regarding the consequences of a kilometer tax seems to be small or even non-existing.

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Key words: factor demand, kilometer tax, manufacturing industry, transport policy.

1.0 Introduction

The purpose of this paper is to examine effects of a kilometer tax, levied on heavy goods vehicles in Sweden, on the Swedish manufacturing industry's factor demand and output. We employ the analysis on different industry sectors and regions. The comparison between industries and regions give insights on the relative sensitivity and thereby provide policy relevant knowledge. The regional aspects are important in a Swedish policy perspective due to that Sweden is a large and stretched out (elongated) country. The focus on road transport intensive industries is motivated by the fact that these can be expected to be most affected by an implementation of a kilometer tax.

A kilometer tax implemented at levels discussed by the Swedish Road Tax Commission (SOU 2004:63) may, for some industry sectors, cause the price of heavy goods road transports to drastically increase.[1] Hence, depending on the cost share for road transportation and the substitution possibilities, it has the potential to noticeably increase the cost of production for some industries and regions. We estimate elasticities for output and factor demand and analyze how sensitive the supply of output (production) and the demand for labor, capital, electricity, fuels, and transport are to price changes.

The introduction of taxes in the transport sector is typically motivated by a mix of allocation and fiscal reasons in line with Pigouvian

[1] Assuming tax levels based on a national weighted average of short-term marginal external costs for countryside (82per cent) and city (18per cent) for a heavy goods vehicle with an engine fulfilling EURO 2. This means a kilometer tax level of 3.67 SEK per vehicle kilometer for a 60 tonne vehicle. Assuming a cost per kilometer before tax of 13.50 SEK per vehicle kilometer, this corresponds to 27 per cent. At present, most trucks are found in EURO 2. At the earliest possible time for an introduction of a kilometer tax, EURO 3 to 4 can be expected to be the most common classes, which will imply lower tax levels.

taxes (Pigou, 1924) and Ramsey taxation (Ramsey, 1927; Mirrlees, 1971; Diamond and Mirrlees, 1971), respectively. In the particular case of a kilometer tax, the Pigouvian rationale is fundamental and well motivated since it internalizes externalities that are not sufficiently accounted for in present prices, including other taxes. The relevant externalities to internalize are primarily emissions to the air except carbon dioxide (CO_2) emissions, since part of the diesel tax is a CO_2 tax specifically targeted on CO_2 emissions and correlate perfectly with carbon content of the fuel, and road deformation, according to the suggested differentiation of the tax. For heavy goods vehicles, emissions and road deformation are both highly correlated with transport distance.

Existing studies of the demand for road freight by heavy goods vehicles have been surveyed by Oum et al. (1992) and Graham and Glaister (2002), who also point to the importance of accounting for firm output decisions. We adopt the approach in a recent paper by Hammar et al (2008) that analyze the consequences of a kilometer tax on the Swedish by introducing transportation as an input in a factor demand model.

The paper is structured as follows. In the next section we present the empirical strategy, which includes our modeling approach and presentation of data. Thereafter we present simulations using estimated elasticities for different scenarios associated with an introduction of a kilometer tax. The final section concludes.

2.0 Empirical strategy

2.1 Modeling approach

In this paper we use essentially the same set up as Hammar et al (2008) but broaden the analysis by incorporating several industry sectors and by a particular focus on regional effects. Different sectors are to a varying degree dependent on road transportation and in this paper we choose to analyze sectors with a cost share for road transportation exceeding 3 percent, i.e. the sectors where the need for analyzing potential consequences are of largest policy concern.

The regional analysis is based on the NUTS 2 regions (see map in Figure A1 in appendix) for the whole manufacturing industry, hence, abstracting from potential structural changes between different industry sectors.[2]

The present model is based on standard micro-economic foundations. We assume (a) that the objective of each individual firm is to maximize profits, (b) that each individual firm operates in a competitive environment,[3] and (c) that each individual firm has access to a technology that transforms a number of inputs into a single output. Assumption (a) implies, *inter alia*, that the firm chooses production level and input demands

[2] The Nomenclature of Territorial Units for Statistics (NUTS) is a geocode standard for referencing the administrative division of countries for statistical purposes. The standard, developed by the European Union, thus only covers the member states of the EU in detail (see also: Regions of the European Union); Eurostat also devised a hierarchy for the 10 countries which joined the EU in 2004, but these are subject to minor changes. The NUTS divisions do not necessarily correspond to administrative divisions within the country. The acronym is derived from the French name for the scheme, nomenclature des unités territoriales statistiques.

[3] This assumption could be relaxed, i.e., allow for imperfect markets, but not without making the model considerably more complex. We would have to have additional data to account for market imperfections and make more or less *ad hoc* assumptions about how the imperfections translate into model specification.

simultaneously. Furthermore, assumption (b) implies that all input and output prices are exogenous to the firm. Assumption (c) implies that we can describe the technology with a production function.

More specifically, we assume that the firms use an input vector **x** = [$x_1,\ldots, x_n$] to produce a single output q. Denote the corresponding input price vector as **w** = [$w_1,\ldots, w_n$], and the output price p. Then, given the assumptions above, we can write the profit function for a representative firm as:

$$\pi = pq^* - \mathbf{w}'\,\mathrm{x}^* = \pi(\mathbf{w}, p)\ , \tag{1}$$

where q* and **x*** are the profit maximizing output and input choices.

The profit function in (1) has the usual properties, implying it is increasing in p, non-increasing in **w**, homogenous of degree 1 in p and **w**, and convex in (p, **w**). Applying Hotelling's lemma to equation (1), we obtain supply and demand as functions of all prices, that is:

$$\nabla_p\left[\pi(\mathbf{w}, p)\right] = q(p, \mathbf{w})\ , \tag{2}$$

$$\nabla_{\mathbf{w}}\left[\pi(\mathbf{w}, p)\right] = -\mathbf{x}(\mathbf{w}, p)\ . \tag{3}$$

In order to obtain an operational form of the demand system we need to specify a functional form for the profit function. The chosen functional form should put as few restrictions as possible on the technology, but still be operational from an econometric point of view. Furthermore, for suitable parameter values it should satisfy the properties associated with a profit function (given by micro-economic theory). In the present study we have chosen to use the normalized quadratic profit function (which entails a fully flexible representation of technology).[4] The selection procedure for the profit function was "trial and error" until finding the most adequate specification in terms of the profit function being well behaved (that is elasticities having the "right" signs). Other specifications were investigated, such as the Translog and the generalized Leontief, but the normalized quadratic specification was superior in terms of producing parameter estimates that generate theoretically plausible properties of the profit function; i.e., input own-price elasticities are negative, input elasticities with respect to output price are positive, output elasticity with respect to input prices are negative, and output own-price elasticity is positive. For recent empirical applications of the normalized quadratic profit function specification in factor demand studies, see Brännlund and Lundgren (2007) or Hammar et al (2008).[5]

Due to the panel data structure, there are several possible approaches to estimate the demand and supply functions. One is to just pool the data or impose fixed effects at some level of aggregation. An alternative, and less restrictive, approach is to allow plants to be heterogeneous at certain levels of aggregation; that is, letting the parameters be sector specific. In practice this means that we estimate sector specific demand systems separately for each sector and region. An advantage with this approach is that it allows all parameters to vary between the different sectors and regions, while a disadvantage is that the chosen level of aggregation does not correspond to

[4] See Lau, 1972, 1974, 1976a-b, 1978, for background discussion and derivation of the quadratic profit function and elasticity formulas.

[5] Other examples of recent factor demand studies performed on US and EU industry data, although not using the normalized quadratic specification, can be found in Rezitis et al (2001), Bauer and Riphahn (2002), and Kriström and Lundgren (2003).

differences and similarities in the actual technology of different firms. However, this is a general problem in this kind of analysis.

In this paper we have chosen the latter approach due to the differences in road transport intensity between the sectors and regions – it would be too restrictive to impose the same parameter values for the transport variable.

Given this approach we can write the normalized profit for a representative firm in sector or region *m*, using standard symmetry condition ($\alpha_{ijm} = \alpha_{jim}$) as:

$$\frac{\pi_m}{p_m} = \alpha_{0m} + \sum_{i=1}^{n} \alpha_{im} \frac{w_{im}}{p_m} + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_{ijm} \frac{w_{im}}{p_m} \cdot \frac{w_{jm}}{p_m}, \quad i, j = 1,\ldots,n \quad m = 1,\ldots,M \,, \tag{4}$$

where *M* is the number of sectors or regions, and *i* and *j* are sub-indices denoting different inputs . The corresponding supply and demand system is then, by applying Hotelling's lemma:

$$q_m = \alpha_{0m} - \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_{ijm} \frac{w_{im}}{p_m} \cdot \frac{w_{jm}}{p_m}, \tag{5}$$

$$x_{im} = -\left(\alpha_{im} + \sum_{j=1}^{n} \alpha_{ijm} \frac{w_{jm}}{p_m} \right) \quad . \tag{6}$$

The econometric specification includes error terms in the profit, supply, and demand functions described above (which are assumed to have white noise properties). By adding a stochastic term to equations (4)-(6), we have a system that can be estimated with standard techniques such as seemingly unrelated equations (SURE) or full information maximum likelihood (FIML); see for example Greene (1993). In the estimations we also include time trends (representing exogenous technological progress) and scale dummies (four different sizes of firm) that interact with prices.

Given (4) – (6), it is straightforward to define the price elasticities for sector or region *m* as:

$$\varepsilon_{ijm} = -\alpha_{ijm}(w_{jm}/p_m)/x_{im}, \tag{7}$$

$$\varepsilon_{ipm} = -\sum_{j=1}^{n} \varepsilon_{ijm}. \tag{8}$$

$$\varepsilon_{pim} = \varepsilon_{ipm}(w_{im}/p_m)(x_{im}/q_m), \tag{9}$$

$$\varepsilon_{ppm} = -\sum_{i=1}^{n} \varepsilon_{pim}. \tag{10}$$

Equations (7)-(10) define the demand elasticities, the supply elasticity with respect to input prices, and the own price supply elasticity.

From theory it follows that the own price supply effect is positive, whereas the effect on supply from an increase in any input price is negative. The own price demand effect is negative, whereas the cross price effects cannot be determined *a priori*. It should be noted that equation (1)-(3) are derived under the assumption that all inputs are flexible. Among other things, this implies that the capital stock is allowed to adjust without lag as a result of price changes. Thus, the model may be viewed as a long run model.[6]

[6] Or more specifically, the model does not distinguish between short run and long run.

2.2 Data

The data set is a plant level unbalanced panel covering the 1990-2001 period. It contains plants with more than five employees and includes plant level data on output (sales), input data on (quantities and values) labor, electricity and fuels used, gross investment, and transport costs.[7] In the official data on transport costs there is no disaggregating between modes of transportation. Since our purpose is to analyze how firms in industries and regions react to road transport price increases we need to handle this shortcoming in some way. We choose to scale the total transport costs according to information on the average share of road transports that are used in respective industry before using the data for our estimation purposes.

The proxy for transport demand is constructed by dividing transport costs by a price index for heavy vehicle transports (more on this index below). Fuels are aggregated into a single variable (70-80 per cent fossil fuels in the aggregate variable). Capital stocks are calculated residually from other data available; value added, cost of capital, and salary paid to employees. Assuming that value added is compensation to labor and capital (salaries plus capital costs), we can extract the capital stock residually.[8]

Output price indices are sector specific, and firm specific input prices are calculated from the costs for labor, electricity, and fuels. Price of transports and capital are not firm specific. The calculations of these indices

[7] It should be mentioned that we have excluded the observations of firms reporting no costs for transportation. The reason is that transport costs for these firms most probably are embedded in other production costs (fuel, labor, capital) or that the transports are so-called “in-house” as opposed to “for-hire”. However, we cannot readily assume that the remaining observations are free of “in-house” transports.

[8] Assuming that value added is $VA = p_L L + p_K K$, i.e., compensation to primary factors of production.

are based on national and industry based indices, respectively (taken from Statistics Sweden, producer price index section at www.scb.se), which seems plausible considering that firms have limited opportunities to affect the prices for capital (global market) and transports significantly. For the transport price we use a weighted index containing price indices for labor cost for employees in the heavy vehicle transport sector, cost of capital, and diesel used as fuel in heavy transportation vehicles, and a consumer price index reflecting the price development of other costs.[9] The weights used here are 42 per cent for labor, 15 per cent for capital, 26 per cent for fuel, and 17 per cent for other costs. For capital cost we use the standard definition of user cost of capital,[10] which is a function of an investment goods index, a sector output price index, an interest rate, and depreciation rates. The depreciation rates used are 8.7 per cent for machinery and 2.9 per cent for buildings (the two main components of gross investments).[11]

In sum, firms produce a sector specific output, and use labor, capital, electricity, fuel, and road transports as inputs. Firms are faced with an output price at the sector level, but pay firm specific prices for labor, electricity, and fuels. Prices of capital and transports are on a sector and national level, respectively.

Selected descriptive statistics of the data used in our analysis are presented in Figure 1 to 3 (see also Table A1 and A2 for cost shares, s, for the input factors by industry and region). From Figure 1, which depicts road

[9] The weights were supplied by Sebastian Bäckström, WSP Analysis & Strategy, and are based on the cost of operating a heavy vehicle in road transportation. See Bjørner (1999) for a study estimating freight transport using aggregate quarterly time series, which use a similar price index as a measure of freight transport.

[10] See for example Jorgenson (1963) or Nickell (1978) for a discussion and derivation of user cost of capital.

[11] These rates are based on estimations from Swedish industry data in King and Fullerton (1984) and Bergman (1996).

transport cost shares for industries that are relatively road transport intensive, it is shown that Mining (not iron ore), Stone and mineral, Food, Wood, Printing, and have road transport cost shares of 5 percent or above. It should be stressed that there also is a variation between firms in every industry, a fact that is explicitly handled in our empirical approach.[12]

In Figure 2 and 3 we see how industry sales and employment is distributed between sectors and regions, respectively. As can be seen, the general pattern to be found is that the variation is larger between industries than between regions.

>>> Figure 1 to 3 about here

3.0 Results

In Table A1 and A2 in the Appendix elasticity matrices of factor demand price elasticities based on parameter estimates made using Full Information Maximum Likelihood, FIML, for each industry and region are presented.[13] We also present how input demand changes when output price increases, and how output changes when cost of production increases (input prices changes). The elasticities should be read as, for instance, a 10 percent cost increase of for road transport, p_t, for the Mining industry (not iron ore) implies that the demand for road transport, T, decrease by 5.2 percent. A star (*) implies that the elasticity is calculated on statistically significant

[12] It should also be mentioned that the proposed kilometre tax will not be levied on private roads in the countryside. This fact implies an over estimation of the effect of an introduction of a kilometre tax when later in the paper simulate effects. In general this over-estimation is small and can be disregarded but can be of importance for some of the transports in the mentioned industries (e.g. mining, wood, and pulp- and paper), for instance where road transports of metal ore to a large extent is conducted within the realms of the mine.

[13] Parameter estimates are available upon request. Statistical significance of the elasicities are calculated using the delta method, which should do an adequate work since elasticities are linear functions of the parameters.

parameter estimates on the 5 percent level. Hence, the above mentioned elasticity should be handled with great care due to the statistical insignificance. Presenting the model estimation results in this compact manner, we believe, is very informative and makes it easy for the reader to interpret them. All elasticities are linear functions of the parameters of the factor demand system, and the profit and supply functions (in most cases a direct linear function of one single parameter), which render them a suitable vehicle to summarize the estimation results in a comprehensive manner. Furthermore, the elasticities make up a complete description of the technology in each sector or region, which makes it easy to immediately get an overlook of whether the properties postulated by theory are present in the profit function.

We see, as expected, that when output price increases, then production increases, and hence the factor demand increases as well. Moreover, we also see that increasing factor prices imply a decrease in production. Output elasticities are based on more aggregate data as the output prices are not firm specific, which also implies that these are more uncertain (relative to the factor demand price elasticities).

For industries, the statistically significant own price elasticities are all, as expected, negative, that is the higher the input price, the less the firm uses this particular input. The own price elasticity of road transportation is significant for three industries: Stone and non-metal mineral industry, food industry, and the wood industry. It can also be noted the elasticities are large; indicating the demand for road transports is highly sensitive to price changes in these sectors.[14] Compared to other factor demands, road transportation is the most price sensitive production factor for these industries. On the other hand, other industries seem not to decrease road transport demand when transport price increase. Still, even if being statistically insignificant, some of the price elasticities of road transportation are large, possibly reflecting that some (relatively few) firms are responsive to price changes even though there are no effects on industry level. It should also be noted that the own price elasticities are typically more often significant for other input factors than transport. Our interpretation of this result is that it reflects that the variation between firms are small when it comes to transport price (to a large extent driven by the need for us to use a nation wide road transport prices).

For regions, it can be noted that road transport prices changes, with a few exceptions, do not seem to affect factor demand. Regarding the negative own price elasticities, these are with transport being the notable exception, statistically significant. It should be remembered that the results on regions includes all firms, i.e. also those with low road transport costs shares, which may explain this finding.[15]

[14] To compare, in the survey by Oum et al. (1992) the elasticities for paper, plastic, and rubber products, and wood and wood products are -1.05 and between -0.56 and -1.55, respectively. In a more recent survey of estimates of price elasticity on the demand for road freight, Graham and Glaister (2002) report a mean of -1.07 based on 143 estimates. Hence, our estimates are in the same range. It should, however, be noted that data and exact NACE classification differ. Direct comparisons are therefore difficult to make.

[15] Disaggregating the regional data into sectors and/or impose a transport cost share ”floor” was not possible due to estimation problems (too little data in some sectors).

4.0 Simulations

In this section we simulate the model for different scenarios associated with an introduction of a kilometer tax using the elasticity matrices presented in appendix. We only simulate effects on sectors, since the results in previous section show that there are little differences across regions and the statistical significance in the estimates are quite low. Before describing the scenarios and the results from the simulations, we wish to draw attention to that the analyzed policy change is assumed not to induce general equilibrium effects. That is, policy changes have effects only on the prices of those inputs directly affected by the specific policy. Naturally, this type of limitation is present in most partial equilibrium analyses. However, in case of a relatively small targeted policy reform, like the proposed kilometer tax, it is reasonable to assume it does not have large economy wide repercussions.[16]

Moreover, we have only considered *road* transport costs. The possibility to switch to other transport solutions is hence not explicitly accounted for. Furthermore, a switch to other transport modes can be assumed to imply an increase in total production costs, even though the increase is smaller compared to "sticking with" road transports. Hence, the calculations do not reflect all production costs. This warrants complementary research on mode choices and transport solutions in the manufacturing industry, for example using results from SIKA's Samgods model (SIKA, 2004).

[16] In fact, the results in Östblom and Hammar (2007) that analyzed the effects of a kilometer tax on the Swedish economy in a CGE-framework, indicate that the effect on industry structure is quite modest (less than 0.5 percent in terms of changes in value added for the 10 percent scenario below) for industries that have low transport cost shares.

In addition to correct behavior, a kilometer tax also raises revenues that may be used for lowering distortionary taxes (or for public investments that increases productivity). We have analyzed the effects of implementing the kilometer tax but not how those revenues could be put to use. If the revenues are used to lower distortionary taxes, as for example income taxes, the effects on production might be positive in total.

We simulate, for each industry sector, two levels of kilometer tax: low and high. The assumption is that the price of road transportation increases by 10 or 30 per cent. However, two things should be mentioned regarding the "high" scenario. First, a transport price increase of 30 per cent is definitely more than marginal, which calls for caution when interpreting the simulation results. Second, 30 per cent may not be a realistic increase in the long run (for example future changes in transport solutions including cleaner vehicles with associated lower tax levels). We still choose to include it as an indication of a "worst case."

The tables displaying simulation results below use the following notations:

D_L = percentage change in labor.

D_K = percentage change in capital.

D_E = percentage change in electricity.

D_F = percentage change in fuel.

D_T = percentage change in road transportation.

D_q = percentage change in output level.

Remember that all simulation results presented in the following section are to be considered long run effects. Changes in production are a result of changes in the input mix, which in turn are due to kilometer tax induced increases in road transportation prices. It should also be mentioned that supposedly small effects on the industry level might imply large effects on the local and/or firm level.

4.1 Effects on industries

The simulation results in Table 2 show a large variation between industries and that a kilometer tax will decrease road transport demand; effects are roughly cut in half for the low level scenario. We also see that effects on production at industry level are small relative to the effects on transportation and other input factors. Still, a production decrease of between one and two per cent can imply large effects on regional and/or firm level, and can be interpreted as an indication of downsizing in these industries.

Moreover, we see that in four out of the nine industries in Table 2 the demand for labor increase. At the same time these four industries decrease their investment, indicating a structural change towards a more labor intensive manufacturing industry. The pattern is reversed in the five industries that decrease labor, i.e. these already capital intensive sectors increase their capital intensity.

The food industry is of large concern due to the large share of employment, industry sales and high road transport cost shares. As can be seen in Figure 4 industry sales will only decrease with less than one percent in the high level scenario, while employment seem to increase, however.

Finally, note that for those sectors where the assumptions on competitive input or output markets might be questioned, the effects on production and employment of higher road transport prices will generally be smaller.

>>> Table 2. about here

5.0 Conclusions

The results in this paper show that road transport prices affect the use of production factors, while the effect is less pronounced in terms of changes in output. It also seems clear that road transport is responsive (but inelastic) to changes in road transport prices, and that this responsiveness is large relative to other production factors. We can also conclude that the same increase in road transport prices will affect input demand and production among industries with high road transport cost shares.

On a general note, the effect of a kilometer tax on a particular firm will depend on the size of the road transport cost share and the possibility to substitute to other production factors. Firms with small road transport cost shares should be able to accommodate for a kilometer tax, while firms that are heavily reliant on road freight may downsize, or even shut down. The industries that can expect relatively large production losses (above 1 % at a high level of a potential kilometer tax) are the stone and non-metal mineral industry.

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7.0 Appendix

Figure A1. Map over NUTS at level 2 in Sweden

Source: Eurostat (2008).

Table A1. Sector elasticities.

		Cost share, s	Wage, w	Price of capital, r	Price of electricity, p_{el}	Price of fuel, p_b	Road transport price, p_t	Output price, p
Mining industry, not iron ore	L	0.430	-0.359*	0.378*	-0.094	0.035	-0.020	0.061
	K	0.314	0.452*	-0.351*	0.092	0.154	-0.037	-0.311
	E	0.041	-0.347	0.283	-0.294	-0.170	1.251	-0.722
	B	0.070	0.241	0.890	-0.319	-1.456*	0.911*	-0.267
	T	0.146	-0.049	-0.073	0.815*	0.317	-0.520	-0.489
	q		-0.012	0.051	0.038	0.008	0.040	-0.125
Stone and non-metal mineral industry	L	0.553	-0.413*	-0.009	-0.059	0.116	-0.029	0.395*
	K	0.232	-0.015	-0.451*	0.055	-0.026	0.007	0.430*
	E	0.032	-0.592	0.342	-0.047	0.360*	-0.299	0.236
	B	0.054	0.202	-0.029	0.063*	0.019	-0.008	-0.247
	T	0.129	-0.098	0.015	-0.101	-0.016	-1.600*	1.801*
	q		-0.081*	-0.055*	-0.005	0.029	-0.110*	0.222*
Food industry	L	0.570	0.057	0.066	0.016	0.003	0.331*	-0.474*
	K	0.268	0.060	-0.457*	-0.012	-0.006	-0.086	0.500*
	E	0.030	0.333	-0.268	-0.226*	-0.048	-1.166*	1.375*
	B	0.033	0.031	-0.070	-0.025	-0.310*	-0.259	0.632
	T	0.098	0.943*	-0.266	-0.161*	-0.070	-0.886*	0.440
	q		0.067*	-0.077*	-0.009*	-0.008	-0.022	0.050*
Wood industry	L	0.578	-0.167*	-0.017	-0.046	0.042	-0.033	0.220*
	K	0.262	-0.024	-0.607*	-0.039	-0.309*	0.245*	0.735*
	E	0.044	-0.418	-0.253	-0.207	-0.374	0.303	0.949
	B	0.022	0.219	-1.138*	-0.213	-1.185*	-0.611*	2.927*
	T	0.094	-0.053	0.281*	0.054	-0.190*	-1.043*	0.951*
	q		-0.023*	-0.055*	-0.011	-0.060*	-0.062*	0.211*
Printing and other paper related industry	L	0.730	-0.463*	0.110*	0.007*	0.008	0.125*	0.212*
	K	0.169	0.335*	-0.110*	-0.004	0.004	-0.099	-0.126
	E	0.013	0.365*	-0.067	-0.236*	-0.357*	0.883	-0.587
	B	0.010	0.370	0.056	-0.300*	-0.559*	2.185*	-1.752*
	T	0.079	0.373*	-0.097	0.050	0.148*	-0.525	0.050
	q		-0.048*	0.009	0.003	0.009*	-0.004	0.031
Rubber and plastic industry	L	0.628	-0.392*	0.285*	-0.018	-0.012	0.066	0.071
	K	0.272	0.481*	-0.210*	0.019	0.040	-0.054	-0.276*
	E	0.037	-0.351	0.215	-0.174*	0.167*	-0.320	0.463
	B	0.018	-0.257	0.489	0.183*	-0.634*	-0.722*	0.941
	T	0.045	0.608	-0.294	-0.155	-0.320*	-0.436	0.598
	q		-0.015	0.035*	-0.005	-0.010	-0.014	0.009
Other manufacturing industry	L	0.723	-0.352*	-0.012	0.011*	0.007	0.049*	0.298*
	K	0.197	-0.025	-0.445*	0.004	0.031*	-0.033	0.468*
	E	0.024	0.504*	0.088	-0.204*	-0.147*	0.607*	-0.848*
	B	0.015	0.307	0.688*	-0.145*	-0.725*	0.424	-0.549
	T	0.041	0.456*	-0.151	0.123*	0.088	-0.229	-0.286
	q		-0.060*	-0.047*	0.004*	0.002	0.006	0.094*
Textile industry	L	0.734	-0.116*	-0.042	-0.025*	-0.092*	-0.006	0.281*
	K	0.187	-0.105	-0.403*	0.008	0.050	0.007	0.444*
	E	0.022	-0.499*	0.064	-0.355*	-0.273*	-0.321*	1.384*

	B	0.023	-1.159*	0.251	-0.172*	-0.395*	-0.111	1.585*
	T	0.035	-0.089	0.038	-0.232*	-0.128	0.182	0.229
	q		-0.064*	-0.041*	-0.016*	-0.029*	-0.004	0.153*
Pulp and paper industry	*L*	0.543	-0.418*	-0.447*	-0.250*	-0.057	-0.168	1.341*
	K	0.328	-0.192*	-0.136*	0.020	-0.001	0.005	0.303*
	E	0.065	-0.517*	0.096	-0.254*	-0.108	-0.048	0.831*
	B	0.033	-0.210	-0.010	-0.191	-0.375*	-0.294*	1.079*
	T	0.032	-1.034	0.078	-0.144	-0.495*	-0.749	2.344*
	q		-0.147*	-0.078*	-0.044*	-0.032*	-0.042*	0.343*

Table A2. Regional elasticities, all sectors.

		Cost share, s	Wage, w	Price of capital, r	Price of electricity, p_{el}	Price of fuel, p_b	Road transport price, p_t	Output price, p
Stockholm	L	0.693	-0.300*	-0.044	-0.048	-0.014	0.041	0.365
	K	0.235	-0.028	-0.377*	-0.043	-0.018	-0.025	0.491*
	E	0.022	-0.679	-0.932	-0.336	-0.580*	-0.371	2.898
	B	0.018	-0.343	-0.683	-1.020*	0.102	0.090	1.853*
	T	0.032	0.278	-0.262	-0.180	0.025	-0.416	0.555
	q		-0.034	-0.072*	-0.019	-0.007*	-0.008	0.140*
Mid east	L	0.672	-0.040	0.215	-0.030	0.051	0.060	-0.257
	K	0.234	0.342	-0.795*	-0.055	0.070	-0.048	0.486*
	E	0.031	-0.374	-0.433	-0.514*	0.996*	-0.134	0.458
	B	0.024	0.551	0.472	0.847*	0.380*	0.636*	-2.887*
	T	0.039	0.476	-0.236	-0.084	0.468*	-0.370	-0.254
	q		0.041	-0.049*	-0.006	0.043*	0.005	-0.035
South east	L	0.652	-0.347*	-0.073	-0.018	0.018	-0.020	0.439*
	K	0.264	-0.100	-0.530*	0.008	0.029	-0.073*	0.666*
	E	0.029	-0.328	0.100	-0.622*	4.307*	-0.220	-3.237*
	B	0.020	0.180	0.211	2.367*	0.252	0.700*	-3.711*
	T	0.035	-0.183	-0.493*	-0.113	0.653*	0.214	-0.079
	q		-0.076*	-0.084*	0.031*	0.065*	0.001	0.063*
South	L	0.666	-0.301*	0.156*	0.004	0.021	0.077*	0.043
	K	0.244	0.154*	-0.491*	0.017	0.016	-0.040	0.344*
	E	0.026	0.062	0.272	-0.458*	0.909*	0.155	-0.940
	B	0.024	0.134	0.105	0.372*	0.073*	0.126*	-0.811*
	T	0.040	0.491*	-0.263	0.063	0.126*	-0.168	-0.249
	q		-0.007	-0.054*	0.009	0.020*	0.006	0.026
South west	L	0.676	-0.125	-0.710*	-0.036	0.220*	0.044	0.606
	K	0.243	-0.551*	-0.863*	-0.017	-0.139*	-0.098	1.667*
	E	0.025	-0.375	-0.225	-0.526*	-0.581*	0.025	1.682
	B	0.022	2.048*	-1.656*	-0.518*	-1.217*	0.131	1.213
	T	0.034	0.271	-0.774	0.015	0.086	-1.283	1.684
	q		-0.079	-0.279*	-0.021	-0.017	-0.036	0.432*
Mid Sweden	L	0.663	-0.176	0.240	-0.277*	-0.052	0.022	0.242
	K	0.232	0.243	-0.422*	0.144	-0.021	-0.062	0.119
	E	0.032	-1.298*	0.671	-0.107	-0.430*	0.042	1.122
	B	0.026	-0.253	-0.102	-0.446*	-0.003	-0.188*	0.992*
	T	0.046	0.117	-0.330	0.048	-0.207*	0.143	0.228
	q		-0.028	-0.014	-0.028	-0.024*	-0.005	0.098
Lower north	L	0.653	-0.433*	-0.188	-0.123	-0.120	0.113	0.752*
	K	0.231	-0.136	-0.266*	0.127	0.000	0.031	0.245
	E	0.042	-0.330	0.470	-0.659*	-0.549	0.078	0.990
	B	0.024	-0.680	0.002	-1.156	-0.992*	-0.253	3.081*
	T	0.051	0.498	0.186	0.127	-0.197	0.143	-0.758
	q		-0.094*	-0.042	-0.046	-0.068*	0.022	0.230*
North	L	0.660	-0.415*	-0.333*	0.027	-0.134	0.086	0.770*
	K	0.223	-0.487*	-0.412*	0.116	-0.103	-0.134	1.021*
	E	0.033	0.129	0.381	-0.413*	-0.855*	-0.012	0.771

	B	0.024	-0.319	-0.167	-0.422*	-0.503	-0.162	1.574*
	T	0.060	0.306	-0.326	-0.009	-0.244	0.099	0.173
	q		-0.110*	-0.099*	-0.023	-0.094*	-0.007	0.333*

Figure 1. Road transport cost shares for industries with high road transport costs in 2001, percentage

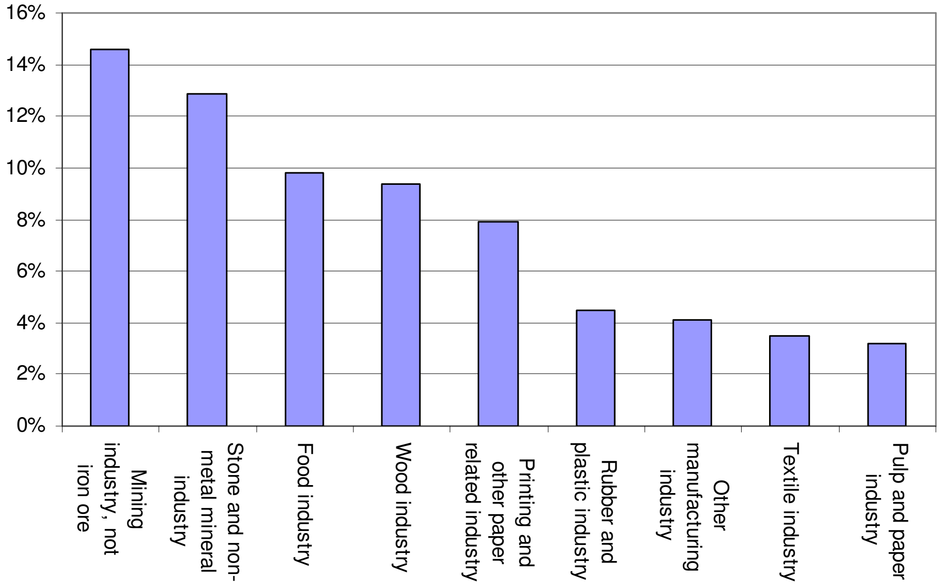

Figure 2. Percentage of total industry sales and employment in 2001, by industry

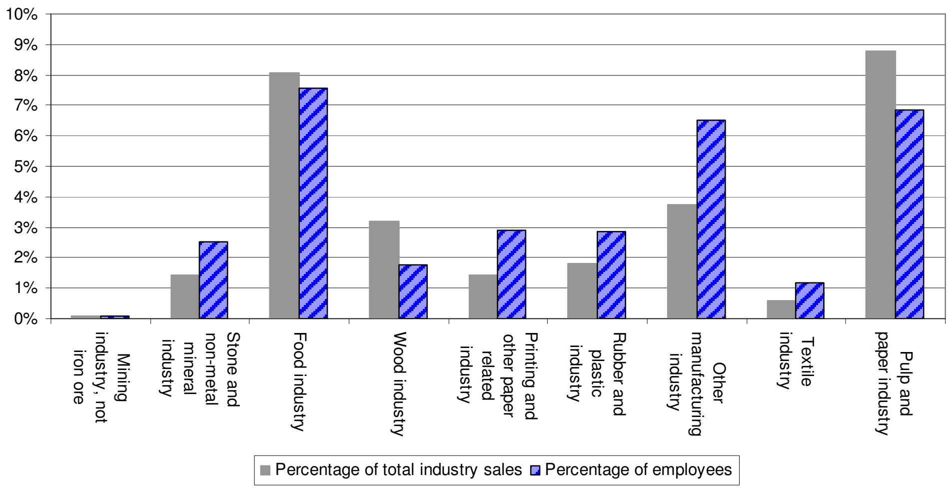

Figure 3. Percentage of total industry sales and employment in 2001, by region

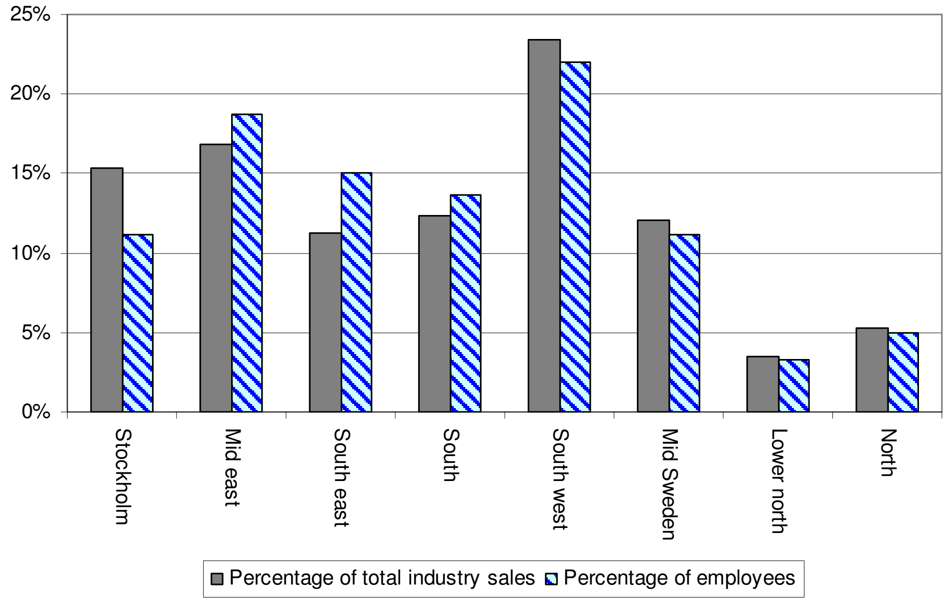

Table 2. Simulation results, effects on industry, low/high refer to different percent increases in the road transport price

	Sim	*D_L*	*D_K*	*D_EL*	*D_B*	*D_T*	*D_q*
Mining industry, not iron ore	Low	-0.003	-0.005	0.156	0.114	-0.065	0.005
	High	-0.005	-0.008	0.288	0.209	-0.120	0.009
Stone and non-metal mineral industry	Low	-0.004	0.001	-0.037	-0.001	-0.200	-0.014
	High	-0.007	0.002	-0.069	-0.002	-0.368	-0.025
Food industry	Low	0.041	-0.011	-0.146	-0.032	-0.111	-0.003
	High	0.076	-0.020	-0.268	-0.060	-0.204	-0.005
Wood industry	Low	-0.004	0.031	0.038	-0.076	-0.130	-0.008
	High	-0.008	0.056	0.070	-0.140	-0.240	-0.014
Printing and other paper related industry	Low	0.016	-0.012	0.110	0.273	-0.066	0.000
	High	0.029	-0.023	0.203	0.503	-0.121	-0.001
Rubber and plastic industry	Low	0.008	-0.007	-0.040	-0.090	-0.054	-0.002
	High	0.015	-0.012	-0.074	-0.166	-0.100	-0.003
Other manufacturing industry	Low	0.006	-0.004	0.076	0.053	-0.029	0.001
	High	0.011	-0.008	0.140	0.098	-0.053	0.001
Textile industry	Low	-0.001	0.001	-0.040	-0.014	0.023	0.000
	High	-0.001	0.002	-0.074	-0.026	0.042	-0.001
Pulp and paper industry	Low	-0.021	0.001	-0.006	-0.037	-0.094	-0.005
	High	-0.039	0.001	-0.011	-0.068	-0.172	-0.010

Figure 4. Simulation results, effects on industry following a high percentage increase in the road transport price due to a kilometer tax.